

ORIGEN2 FOR THE IBM PC

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ABSTRACT

The ORIGEN2 isotope generation and decay code has been implemented on an IBM Microcomputer with a hard disk. The hard disk is required for storage of the cross section and decay libraries. Plans for future development include a data base for the output and a graphics module for viewing the output.

The purpose of this paper is to give a summary description of a revised version of the ORIGEN2 isotope generation and depletion code, named ORIGEN2 PC. The ORIGEN2 code is a versatile point depletion and decay computer code for use in simulating nuclear fuel cycles and calculating the nuclide compositions of materials contained therein. This code has been acquired by many organizations and distributed World-Wide.

Although originally intended for use in generating spent fuel and waste characteristics (composition, thermal power, etc.) that would form the basis for the study and design of fuel reprocessing plants, spent fuel shipping casks, ORIGEN calculations have been used in environmental impact studies and nuclear fuel cycle simulations. Because the code is used so widely, a personal computer version of ORIGEN2 is felt to be of great value to waste management personnel. In addition, the economics for making a large number of calculations support the PC. It makes state-of-the-art calculational capability available to a variety of users.

The personal computer (PC) chosen for the implementation was the IBM PC which has significant calculational capabilities which include:

1. One million bytes of addressable memory space.
2. Several high order languages including FORTRAN.
3. A numeric co-processor, the Intel 8087, for hardware floating point operations.

The numeric co-processor allows 80 bits of precision for numeric calculations and performs these calculations up to two orders of magnitude faster than the standard CPU for the PC. Double precision on the IBM 3033 utilizes 64 bits for calculations. Numeric results are computed to a higher precision on the PC.

At the time of inception of this project the Microsoft FORTRAN compiler was used. The initial version of the compiler suffered from a lack of standard features found in the main frame FORTRAN and numerous errors were detected. The latest version

3.22 appears to perform in an acceptable manner. The IBM Professional FORTRAN compiler for the PC has not been used at this time.

ORIGEN2 utilizes several versions of the MAIN routine to allocate different array sizes depending on whether the problem type is an irradiation or decay. For irradiation cases MAIN01 is used which requires 540 kbytes on the IBM 3033 (overlaid). For the IBM PC version MAIN01 requires 600 kbytes of memory.

A PWR fuel element irradiated to 33000 MWD was used to compare ORIGEN2 with ORIGEN2 PC. Table I compares the running times for the cases. The PWR irradiation case consisted of 44 time steps and was run on the IBM PC/XT and IBM PC/AT.

Table I
Calculational Times for ORIGEN2 PC

Case	ORIGEN2	ORIGEN2 PC	
	3033	PC/XT	PC/AT
PWR IRRAD	2 min.	500 min.	170 min.
Decay*	2 secs.	12 min.	4 min.

*Actinides Only

Because of the large volume of output that is produced with ORIGEN2 it is impractical to print the output on the PC without a high speed line printer. This problem of retrieving the output suggests future improvements for the code. By storing the output in a database a rapid retrieval can be accomplished and the needed results printed.

Plans for future development include a database for storage of the results and possible incorporation of a graphics module for viewing the data.